A PRICE INDEX OF OIL STOCKS

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For a number of years the writer has been conducting a continuing economic study of the petroleum industry, based partly upon the relatively ample statistics with which this field is favored and partly upon the technology involved in the production, refining, and utilization of petroleum.* In order to ascertain whether the course of petroleum shares on the stock market is influenced by economic conditions peculiar to petroleum or is wholly a function of the forces common to the movement of industrial shares in general, a price index of oil stocks has been prepared and will be maintained. A brief description of the method employed and the results attained is herewith presented.

The preparation of a practical stock index involves greater difficulties than many other types of indices, owing to the rapidity and the degree of scatter characteristic of the individual quotations, and the tendency of some of the items to die away and thus "load" the index with inactive components. The conventional type of index as calculated by financial journals and consisting merely of an arithmetic mean of a selected number of quotations is a crude expedient, as has been critically shown by Wesley C. Mitchell.† The main trouble with this type of index is that it is dominated by the more vigorous of its components and is, therefore, not a representative index.

Obviously, if the more vigorous and more costly stocks are not to dominate in an index, the items must be weighted. The weights may be assigned directly to the items or introduced indirectly by converting the quotations into percentages of a fixed base. The latter method was preferred because it affords a double comparison and lends itself to convenient treatment.

In the preparation of the oil index twenty petroleum stocks were selected: five Standard Oil shares; 5 shares of representative companies listed on the New York Stock Exchange; 5 shares of companies listed on the New York Curb; and 5 shares of companies operating primarily in foreign countries. A monthly average price was calculated by averaging the closing quotation on Friday of each week. The monthly averages so obtained were then converted into index numbers representing for each item the percentage of its average price in 1919.

* The writer believes that a combination of statistics and technology opens up a very fertile field for research in industrial economics.

† "A Critique of Index Numbers of the Prices of Stocks." *Journ. Polit. Econ.*, July, 1916, pp. 625–93.

The next step was the calculation of a representative average of the twenty index numbers for each month. An arithmetic average offers the objection that the stocks which decline most rapidly in price have a decreasingly important effect upon the average. This difficulty is largely overcome by use of the geometric mean which accentuates the weight of the smaller index numbers. The median was also determined.

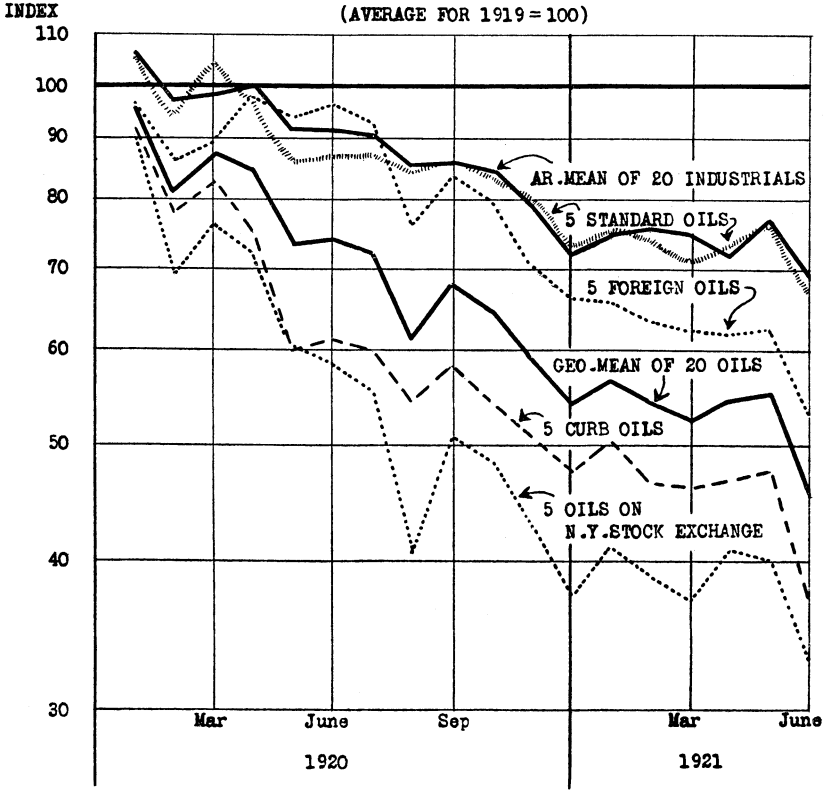

FIGURE 1.—Comparison of the geometric mean, arithmetic mean, and median of 20 oil stocks by months, 1920–21.

The three composites so obtained—geometric mean, arithmetic mean, and median—are given on a semi-logarithmic scale in Figure 1 by months for 1920–21. It will be observed that the three curves show closely concordant fluctuations, but the geometric mean falls below the arithmetic mean, and both show a greater decline than the median. The geometric mean indicates sharper month-to-month fluctuations than does the arithmetic average. The median seems

somewhat erratic in months of abrupt change such as June. The data on which Figure 1 is based are given in Table I.

The geometric mean of the 20 oils and of each of the four component groups are plotted on a semi-logarithmic scale in Figure 2. The arithmetic mean of 20 industrials, as calculated by Dow, Jones, and Co. and published in Bradstreet's, is also entered upon the chart for purposes of comparison after the figures have been reduced to percentages of their average in 1919. It is to be noted that the curve for 20 oils moves in conformance with the curve for 20 industrials, but the month-to-month fluctuations for oils are more accentuated and the trend over the period shown is more sharply downward than for industrials in general. The reason for this is that the oil shares are more "speculative" than the run of items entering in the average industrials.

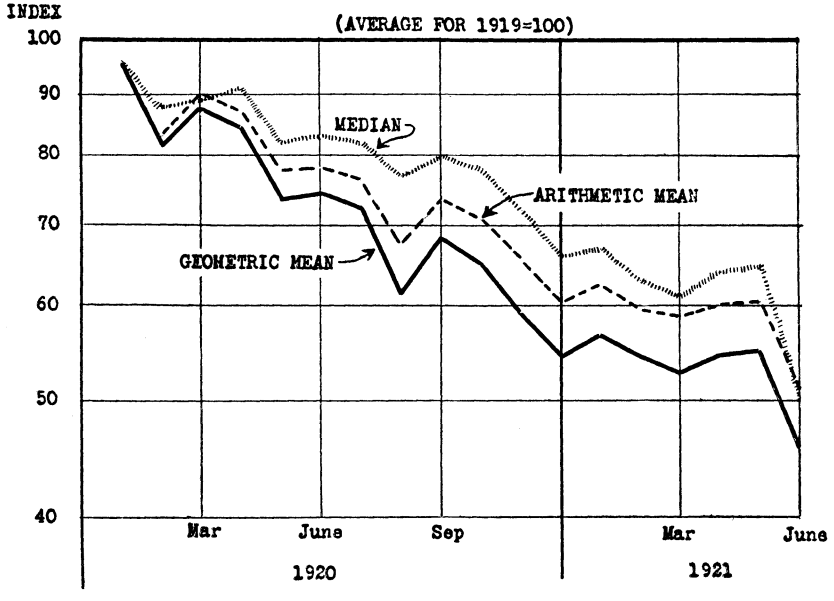

FIGURE 2.—Price of 20 oil stocks by months, 1920–21, together with prices of four component groups, compared with the price of 20 industrial stocks.

Turning next to the components of the oil average, while we recognize that five items form a rather meager sample for each group, we nevertheless observe a certain consistency. The Standard oils, representing the most stable class of oil stocks, conform very closely to the course of the 20 industrials. The foreign oils follow to some degree the course of 20 industrials during 1920, but depart downward rather sharply in 1921. The Curb oils and the New York Stock Exchange

oils are next in order; the latter show the more decided month-to-month fluctuations and the greater ultimate decline from the 1919 average. Whether these relationships will be maintained will be disclosed as the indices are calculated over the months ahead.

TABLE I

PRICES OF OIL SHARES BY MONTHS, 1920–21, COMPARED WITH PRICES OF 20 INDUSTRIALS, IN PERCENTAGES OF THE FIGURES IN 1919

	Geometric mean of					Arith. mean	Median	Arith. mean
	5 Standard oils	5 Foreign oils	5 Curb oils	5 oils on N. Y. Stock Exchange	20 oils	20 oils	20 oils	20 industrials
1919:								
Year.....	100	100	100	100	100	100	100	100
1920:								
Jan.....	105.3	96.5	92.0	90.5	95.9	96.6	96	106
Feb.....	94.6	86.6	78.3	69.1	81.6	83.0	88	97.0
Mar.....	103.4	89.8	83.2	76.6	87.7	89.6	89	98.2
Apr.....	96.4	97.8	75.2	72.5	84.6	87.1	91	99.8
May.....	86.1	94.0	60.6	60.8	73.9	77.7	82	91.3
June.....	87.4	96.1	61.4	58.8	74.2	78.1	83	92.0
July.....	87.1	93.0	60.0	55.8	72.2	76.1	82	91.0
Aug.....	84.9	76.9	54.6	40.9	61.7	67.5	77	85.5
Sept.....	86.6	84.0	58.6	50.9	68.3	73.6	80	86.5
Oct.....	83.7	80.0	54.5	48.6	64.9	70.9	78	85.0
Nov.....	80.2	70.9	51.0	42.8	59.3	65.7	72	79.5
Dec.....	73.5	66.6	47.6	37.4	54.3	61.1	66	72.3
1921:								
Jan.....	75.8	66.0	50.5	41.1	56.8	62.3	67	75.0
Feb.....	74.2	63.4	46.7	38.8	54.3	59.7	63	76.0
Mar.....	71.7	62.6	46.2	37.1	52.7	58.8	61	75.2
Apr.....	73.9	62.1	46.9	41.0	54.5	60.0	64	72.1
May.....	76.4	62.8	47.7	40.1	55.0	60.5	65	77.0
June.....	67.1	53.0	37.1	33.0	45.7	51.0	50	69.3

In order to compare the price trend of oil shares with the course of commodity prices in the petroleum industry, index numbers representing the weighted average price of crude petroleum and of petroleum products are compared with the index numbers of 20 oil shares in Table II. The weighted average for crude petroleum represents five grades, and the weighted average for petroleum products is a weighted composite of individual averages for gasoline, kerosene, fuel oil, and lubricating oils.* The tabulation shows that the price of oil shares over the period shown declined independently of the trend of commodity prices in the petroleum industry, following the course of the

* Corresponding monthly index numbers for the entire period, 1913–21, will be found in Pogue, *The Economics of Petroleum*, New York, 1921, from which the commodity numbers shown above were recalculated.

stock market. This, of course, is normal, although it is interesting to note that the sharp advance in the price of crude petroleum and its products that characterized the first quarter of 1920 was without apparent effect upon the price of oil shares in the stock market.

TABLE II

COMPARISON OF THE AVERAGE PRICES OF CRUDE PETROLEUM, PETROLEUM PRODUCTS, AND 20 OIL SHARES, IN PERCENTAGES OF THE FIGURES IN 1919

	Crude petroleum	Petroleum products	20 oil shares
1919:			
Year	100	100	100
1920:			
Jan.	127	119	95.9
Feb.	131	127	81.6
Mar.	152	140	87.7
Apr.	156	143	84.6
May	158	147	73.9
June	158	152	74.2
July	159	148	72.2
Aug.	159	149	61.7
Sept.	159	149	68.3
Oct.	159	144	64.9
Nov.	158	139	59.3
Dec.	155	135	54.3
1921:			
Jan.	146	125	56.8
Feb.	97	111	54.3
Mar.	88	103	52.7
Apr.	89	101	54.5
May	80	89	55.0
June	64	86	45.7

In conclusion, the geometric mean of fixed-base relatives is employed as a satisfactory type of index number for the price of oil shares, and it is shown that the price course of oil shares in the stock market during 1920–21 followed the price trend of industrial shares in general, though registering sharper fluctuations and greater declines than the latter. Also, the price of oil shares was uninfluenced to any substantial degree by the sharp advance in the prices of crude petroleum and its products in early 1920.